A NEW CAVERNICOLOUS HARVESTMAN FROM LAVA TUBE CAVES IN TROPICAL AUSTRALIA (ARACHNIDA: OPILIONES: PHALANGODIDAE)

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Zalmoxis lavacaverna sp.nov. is from lava tube caves in the Mt Surprise area, north Queensland. It is the first cave-adapted harvestman to be described from tropical Australia. Troglomorphies include depigmentation, eye reduction, and elongation of appendages and spines on pedipalp. ☐ *Arachnida, Opiliones, Phalangodidae, Zalmoxis lavacaverna, new species, cavernicolous, tropics, Australia.*

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Hitherto, no harvestmen displaying cave adaptations (troglomorphies) have been described from caves in tropical Australia. *Zalmoxis lavacaverna* sp.nov. inhabits lava tubes in inland northern Queensland and shows depigmentation, some eye regression, elongation of spines on the pedipalp and elongation of appendages.

Elsewhere in Queensland, a cave adapted species has been recorded from Hercules Cave in the limestone tower karst region of Chillagoe (Howarth, 1988). This has proved to be another species of *Zalmoxis* but its description will await the discovery of a male.

Z. lavacaverna belongs to the family Phalangodidae, a group with many cavernicolous representatives in the Northern Hemisphere (e.g. Vandel, 1965; Briggs, 1968), though these are not closely related to *Zalmoxis*. Two troglomorphic phalangodids in the genus *Chrondrobunus* have, however, been recorded from a limestone cave in New Guinea (Smith, 1980). The Phalangodidae, together with the Assamiidae, are tropical elements that replaced the older, more temperate families as Australia drifted northwards and established biological contact with Asia.

The temperate caves of southern Australia are populated by species of Triaenonychidae, predominantly the genera *Hickmanoxyomma*, *Holonuncia* and *Lomanella* (Hunt, 1990, 1992; Hunt and Hickman, in press). These southern caves seem to support higher numbers of cavernicolous harvestmen, though this may be a consequence of more collecting and research.

Environmental parameters and faunal diversity of the lava tube caves are discussed by Howarth (1988) and Howarth & Stone (1990). He (1988) believed the biospeleological potential of tropical caves in Australia was only just beginning to be appreciated.

Abbreviations: BMH=Bishop Museum, Hawaii; QM=Queensland Museum, Brisbane; BL=body length, BW=maximum body width, SL=scute length, CW=maximum carapace width, PFL=pedipalp femur length, FIV=femur IV length, CSL=cheliceral second segment length.

Zalmoxis lavacaverna sp.nov. (Fig. 1)

MATERIAL EXAMINED

HOLOTYPE: QM S20731, Queensland, Collins Two-Ten Cave, Spring Creek Station, Mt Surprise, 21 Jan 1989, M. Ashe, F.G. Howarth & H. Hoch, male.

PARATYPES: QM S20732, same data, female; BMH, same data, male & female.

OTHER MATERIAL: QM S20733, Queensland, Long Shot Cave, Spring Creek Station, Mt Garnet, 20 Jan 1989, F.G. Howarth, M. Asche, H. Hoch & D. Irvin, male; QM S20734, same data, juvenile.

DIAGNOSIS

Cavernicolous. Depigmented, eyes reduced, 5 segments in tarsus IV.

DESCRIPTION

Male. Body. BL 3.10-3.15, SL 2.97-3.11, CW 1.01-1.10, BW 1.92-2.03. Depigmented, colour straw yellow to yellow-orange, appendages likewise. Anterior margin below with a process between chelicerae and between each chelicera and pedipalp, anterior margin above with 2 tubercles above each pedipalp coxa. Eyemound well developed, rising steeply a short distance behind anterior margin, armed with 1-3 tubercles, sloping less steeply posteriorly. Eye small, set low on

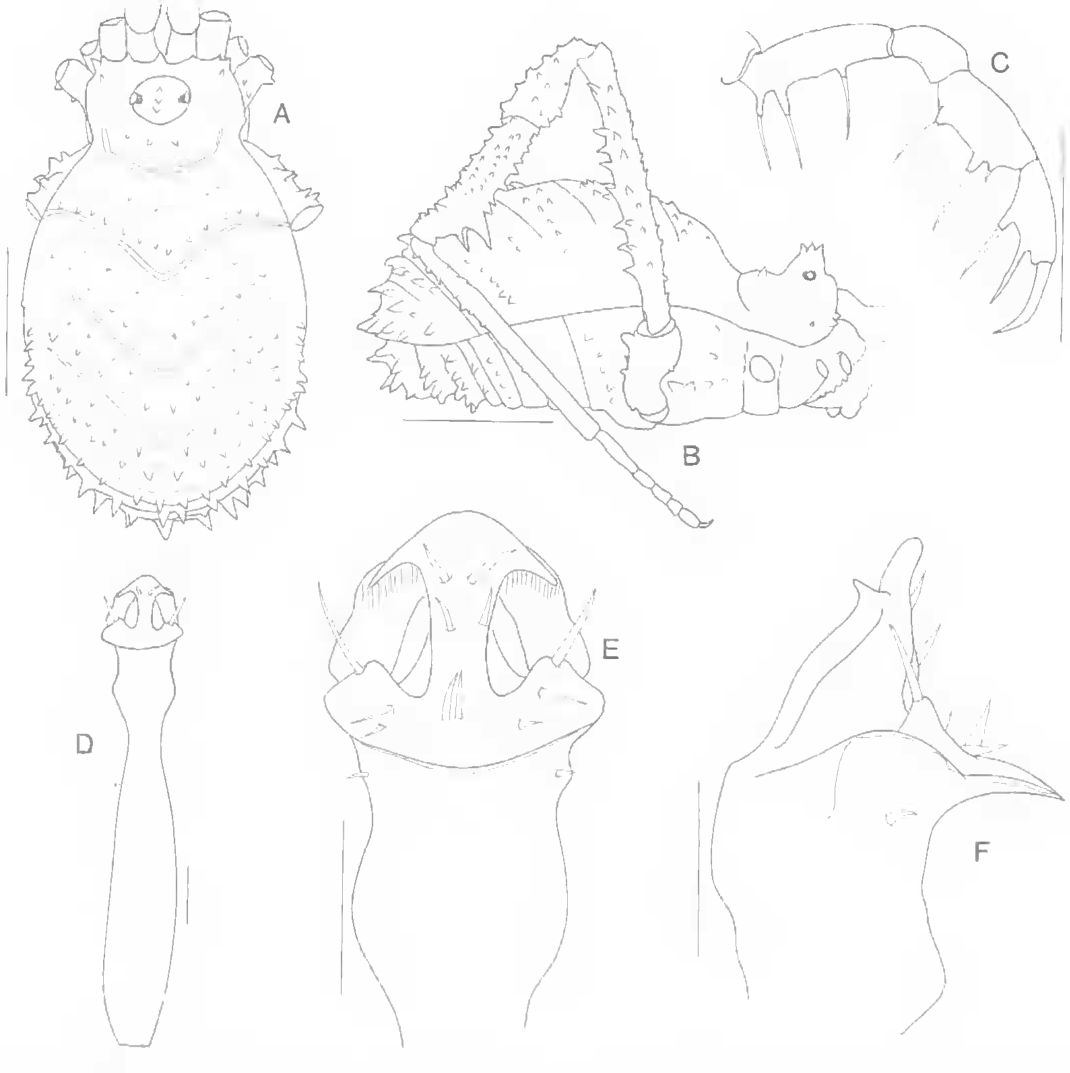

FIG. 1. *Zalmoxis lavacaverna* sp.nov., holotype male. A, body, dorsal; B, body, lateral, with leg IV; C, pedipalp, retrolateral; D, whole penis, ventral: E-F, apical part of penis, ventral and lateral. Scale bars: A-C = 1.0mm; D-F = 0.1mm.

eyemound, surrounded by small halo of pigmentation. Carapace with a few small tubercles as shown (Fig. 1A). Tergal areas 1-5 bearing a transverse row of tubercles or spines near their posterior margin, spines on TA 4 and 5 largest; TA1 - TA4 with second more anterior row composed of granules; TA5 narrow and without secondary row. The 3 free tergites each with row of strong spines; anal operculum and posterior sternites also carrying strong tubercles/spines (Fig. 1B).

Chelicera. Second segment with tiny setose granulations; CSL 0.80-0.84.

Pedipalp. PFL 0.64-0.66; femur with a two closely spaced proximoventral spines (Fig. 1C), a smaller spine ventrally at about 0.66 femur length, and a prolateral spine at about 0.75 femur length. Patella with a prolateral spines in distal half; tibia with 3 pro- and 3 retrolateral spines, most distal retrolateral spine small, remaining two retrolateral spines larger than prolateral spines. Tarsus with two pro- and two larger retrolateral spines. Setae of all spines very long. Claw subequal to tarsus.

Legs. FIV 2.20-2.34 Femora with granules enlarging to tubercles/spines on ventral surface; spines particularly strong on femur IV. Tibia IV with strong subdistal ventral spine, spines distal to it may be subequal to or stronger than other ventral spines; otherwise patella IV to metatarsus IV coarsely tuberculate. Tarsal formula 3,5-6,5,5.

Penis. A marked ventral shelf-like projection bears 4 pairs of setae, 1 mesial pair placed close together, 2 pairs more laterally, and 1 seta inserted on each side in dorsolateral projection of shelf. 2 mesial pairs of setae are placed more distally, setae further apart than proximal mesial pair. One small pair placed below (proximal to) shelf on ventrolateral margin of penis.

Female. Differs from male in the following: much smaller, BL 2.23-2.53, SL 2.12-2.31, BW 1.54-1.57, PFL 0.53-0.57, FIV 1.52-1.54. Body and legs with more subdued spination, large distal spine on tibia IV lacking. Tarsal formula 3,5,5,5.

VARIATION

Spination of the eyemound varies — eyemounds with 1 spine appear more conical. The strong spine on tibia IV in males varies in strength.

COMMENTS

On the basis of penis structure and spination of the body, *Z. lavacaverna* seems closely related to *Z. cardwellensis* Forster, 1955, which occurs in the coastal ranges directly to the east. It differs from *Z. cardwellensis* in being depigmented, having much longer appendages, a less bulbous femur IV, and 5 instead of 6 segments in tarsus IV. The female of both species is much smaller than the male. The undescribed troglomorphic species from Hercules Cave, Chillagoe, differs from *Z. lavacaverna* in having a more conical eyemound, more subdued spination of body and legs, and 6 rather than 5 segments in tarsus IV.

ETYMOLOGY

The specific epithet is formed by a latinised combination of two nouns, lava and cavern, descriptive of the species habitat.

NATURAL HISTORY

The species was taken well inside the lava tube caves where 98-100% humidities prevail (Howarth, 1988). Howarth regarded the species as 'possibly a troglobite'. The caves support a very large troglobitic and troglophilic fauna because tree roots and bat guano provide a steady flow of energy and nutrients to the community.

DISTRIBUTION

North Queensland: Long Shot and Two-Ten Caves, Collins lava tube system, Mt Surprise area. It does not seem to occur in the Bayliss lava tube, 30km to the NW, despite this cave having a rich troglobitic fauna (Howarth & Stone, 1990). This supports the view that *Z. lavacaverna* is an obligate cavernicole incapable of long dispersals across the surface.

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